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Undergraduate research by Dan Seidenkranz '13, Woodbury, published in peer reviewed chemistry journal

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Summary: The undergraduate solar cell research of Dan Siedenkranz was recently published.

(April 11, 2012)-The undergraduate solar cell research of Dan Seidenkranz, under the direction of associate professor of chemistry Ted Pappenfus, has been published in the recent issue of the organic chemistry journal Heterocycles. Their research, funded by the University of Minnesota Initiative for Renewable Energy and the Environment (IREE), sought to find more efficient means of synthesizing molecules in a family of compounds called benzodithiophines, which are promising in the emerging field of organic solar cells.

The term “organic” applies to any carbon-based molecule. Some organic compounds are capable of converting sunlight into electrical energy in much the same way as traditional cells made from silicon, but can be used in inks and paints, eliminating the need for bulky panels made by energy intensive processes.

“If you want to power the world with the sun you need to be able to cover a large area cheaply,” Pappenfus said. “The ability for these materials to be painted onto objects—like a car, building rooftop, telephone pole, or sun umbrella—allows a great deal of flexibility in their use and coverage.”

The organic chemistry journal where the article appears, Heterocycles, is published by the Japan Institute for Heterocyclic Chemistry and brings together research from around the world. Funding for IREE, which has provided a number of grants to research projects at Morris, comes from monies set aside by the Minnesota State Legislature for research initiatives in the field of renewable energy.

Seidenkranz and Pappenfus worked together to review the existing research on benzodithiophene and design an experiment that would allow for novel findings.

“Discovering more efficient means of using these materials is crucial if they are to be made on a large scale,” Pappenfus said. “The literature describes one way to make these materials, but we wanted to see if we could make them more efficiently.”

Seidenkranz then studied three variations of the compound, looking at the electronic properties that contribute to the efficiency of each for converting sunlight into energy, and how they can be better synthesized and integrated into solar paints and inks.

“One of the compounds we experimented with has never been reported in the literature before,” Seidenkranz said, “and we found ways of synthesizing the others more efficiently than what’s in the literature, as well. For example, the method we produced eliminates a step in the current process that involves hydrogen gas, which is very flammable.”

Seidenkranz is a native of Woodbury, Minnesota and a junior at Morris. He said he chose to attend Morris because of the warm, family-like atmosphere of the campus.

“When I visited campus before entering, I was blown away by the hospitality of everyone here. I also liked the small-town feel of Morris and the tight campus community.”

Seidenkranz says that he’d become interested in environmental chemistry in high school and decided to pursue organic chemistry after coming to Morris because of the university’s focus on sustainability.

“Contributing to a sustainable future is important to The University of Minnesota, Morris, and so you could say that doing this research has helped me to become a sustainability enthusiast myself.”

Seidenkranz got involved with the project after seeing signs posted in the science building calling for students interested in doing summer research on organic solar cell development.

“I wanted to see if organic chemistry could be a potential future career path,” Seidenkranz said. “I saw it as an opportunity to go beyond my usual classwork and get research experience that might help me apply to jobs or graduate programs in the future.”

Seidenkranz said he felt shocked and honored that his research as an undergraduate would be published in a peer-reviewed scientific journal. Pappenfus said that including undergraduates in serious research is important for helping them develop skills and experiences that will contribute to their professional development, as well as understanding the important issues facing society.

“It’s so important to recognize and understand the problems we face as a planet in terms of creating a sustainable future,” he said. “I think chemists will play a very important role in overcoming the scientific challenges to sustainable energy, and providing opportunities for research in this field is a straightforward way for undergraduates to immediately engage in addressing these problems.”

“For me, the fact that Morris is a small school allows for a much closer relationship between students and faculty,” Seidenkranz added. “I can stop by my professors’ offices and talk about all kinds of things—coursework, research, life—in a way that being at a bigger school might not allow. The small classes and this one-on-one interaction, I think, have allowed me to delve deeper into this important research and consider it as my future career.”